ORIGINAL ARTICLE

# Partial nail avulsion with matrix excision versus phenolisation as a treatment modality of ingrown toenail; A randomised control trial

Syed Shams ud Din, Inayat ullah Baig, Mirza Tassawar Hussain, Erum Khan, Talha Humayun, Aqsa Syed

**Abstract**

**Objective: The aim of this study was to compare the surgical techniques commonly employed in the treatment of ingrown toenail (IGTN) i.e. partial nail avulsion with matrix excision versus partial nail avulsion with localized phenol use.**

**Study design: Randomised control trial**

**Setting: Department of Surgery, Federal Government Polyclinic Hospital (FGPC), Islamabad**

**Duration: 1st February 2022 to 31st July 2022.**

**Material and Methods: A total of 182-patients with ingrowing toenail (IGTN) were recruited for the study which were randomly assigned in two groups. Partial nail avulsion was done in all the patients. One group underwent matrix excision while phenol was used locally after partial avulsion in the other group. All the procedures were performed by one surgeon. The primary outcome was to assess the recurrence, spike formation and post-op pain and infection in either group.**

**Results: Among 182-participants, 55.5% (n=101) were males. The mean (SD) age in population recruited was 28.66 (9.63). Partial nail avulsion with localized phenol use gave significantly better results compared to partial avulsion with matrix excision in terms of post-operative pain, recurrence, and spike formation. However, no significant difference was found in terms of post-operative infection in either group.**

**Conclusion: The partial nail avulsion with localized phenol use is a significantly better modality compared to partial nail avulsion with matrix excision for the management of IGTN.**

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**Federal Government Polyclinic Hospital, Islamabad**
SS ud Din
I ullah Baig
MT Hussain
E Khan
T Humayun
SR Kalwar

**Dr Akbar Niazi Teaching Hospital, Islamabad**
A Syed

**Correspondence:**
Dr. Talha Humayun
Postgraduate Resident, General Surgery, Federal Government Polyclinic Hospital, Islamabad
Cell No:+92 332-5451992
email: talhahumayun7@gmail.com

**Introduction:**

Onychocryptosis or ingrown toenail (IGTN) is the commonest condition of foot with an estimated 20% of the patients presenting with the condition to a doctor in hospital-setting.[1,2] Surgeons come across ingrown toenail (IGTN) frequently in clinical practice with a rough estimate of about 10,000 new cases per year in United Kingdom.[3] It is a discomforting rather painful condition in which the edge of the nail, usually big toe, grows into the surrounding paronychium (soft tissue). This leads to inflammation and, sometimes, infection of the soft surrounding tissue. IGTN can involve any age group but the incidence is mounting between 11 and 30 years.[4] Numerous etiologies are proposed leading to this condition including ill-fitted shoes, trauma, genetic susceptibility, and fungal infections like onychomycosis.[5] Patient usually presents with pain in the affected nail leading to walking difficulty and sometimes infected surrounding tissue with functional consequences.

There are several conservative and surgical therapy options for IGTN. The non-operative treatment includes topical antibiotic ointment application to the afflicted nail fold at least twice daily after the affected toe has been soaked in warm, soapy water for ten minutes.[6] Patients and carers are given nail care advice, including

how to avoid wearing shoes that are too tight and aggressive nail clipping. Instead of attempting to mould the distal corners of the nail into a smooth round edge and running the danger of leaving a sharp spike of nail at either the medial or lateral corner, they are recommended to cut the nail so that the distal corners of the nail are visible and distinct. The surgical approach includes nail avulsion alone, partial nail avulsion with matrix excision, and radical excision (Zaddik's procedure); but they all have substantial recurrence rates.[1,7,8]

According to the research, using phenol may be advantageous for the majority of patients, but at the expense of an elevated risk of post-operative infection.[9] The current study's objective was to compare and contrast two surgical procedures for IGTN i.e. partial nail avulsion with phenolization versus partial nail avulsion with matrix excision in order to design some regional recommendations to lower the recurrence rates and infection which in turn enhance the clinical outcome of patient and reduce the hospital burden.

**Material and Methods**:
A randomized control trial was conducted at Department of Surgery, Federal Government Polyclinic Hospital (FGPC), Islamabad. The study spanned over a period of 6-months i.e. February 2022 to July 2022. The study recruited 182-participants of any age with clinical condition of IGTN presenting to the surgery department. Patients with diabetes mellitus (DM) and peripheral vascular disease (PVD) were excluded from the study. The participants were randomized in two groups (A or B) with simple random sampling.

Participants in group-A underwent partial nail avulsion with excision of matrix while participants in group-B underwent partial nail avulsion with phenolization of the matrix (local application of phenol). A single surgeon performed all the procedures as day-care treatment under strict aseptic measures. Povidone-iodine solution was used to scrub prepare the affected toe and 0.5% lidocaine-HCl used as local anesthetic agent applied with standard 1cc-syringe to achieve ring block. A tourniquet was applied at the base of the toe to secure hemostasis. Using 11 number standard surgical blade, incision was made at the base of nailfold followed by lifting the affected part of nail from its bed and longitudinally excising with scissors. Whether the affected part of nail was completely removed, a macroscopic examination was performed. In group-A, this partial nail avulsion was followed by excision of nail matrix surgically. In group-B, the partial nail avulsion followed the use of aqueous solution of phenol (85%) applied using a cotton bud. The phenol was infiltrated at the affected nailfold underneath the cuticle for approximately one minute after which it was rinsed with 70% isopropyl alcohol to neutralize the effect of phenol. After the intervention in either group, a compression bandage was applied and patients were advised post-operative care.

A structured questionnaire was used to capture pertinent medical history. The study groups were then evaluated at 2$^{nd}$ and 7$^{th}$ day for post-operative pain (VAS). Post-operative infection was evaluated at 7$^{th}$ day of follow-up. Recurrence and spike formation after the procedure was evaluated at 1 and 6 months on follow-up. The study was approved from the ethical review committee of Federal Government Polyclinic Hospital (FGPC). Before participating in the research study, informed written consents were obtained; anonymity and confidentiality were maintained throughout the study period.

Data was entered and analyzed using SPSS version 23.0. The categorical variables were analyzed using Chi Square test and a p-value of less than 0.05 was deemed significant.

**Results**:
During the course of study, 182-participants (n=182) were enrolled. The majority of the participants were young adults with the mean (SD) age of 28.66 (9.63) years. The study population had male predominance i.e. 55.5% (n=101) vs female population i.e. 44.5% (n=81).

Our results showed that patients in group-B

Table 1:Comparison of pain in Phenolization vs Matrix excision

| Pain | Phenol | Excision | p-value |
|---|---|---|---|
| VAS at day 2 | | | |
| No | 7 (3.8%) | 2 (1.1%) | 0.000 |
| Mild | 60 (33%) | 28 (15.4%) | |
| Moderate | 18 (9.9%) | 48 (26.4%) | |
| **Severe** | 6 (3.3%) | 13 (7.1%) | |
| VAS at day 7 | | | |
| No | 77 (42.3%) | 60 (33%) | 0.031 |
| Mild | 9 (4.9%) | 20 (11%) | |
| Moderate | 4 (2.2%) | 7 (3.8%) | |
| Severe | 1 (0.6%) | 4 (2.2%) | |

Table 2:Comparison of infection in Phenolization vs Matrix excision

| Infection | Phenolization | Matrix excision | p-value |
|---|---|---|---|
| Present | 4 (2.2%) | 7 (3.8%) | 0.351 |
| Absent | 87 (47.8%) | 84 (46.2%) | |

Table 3:Comparison of parameters in Phenolization vs Matrix excision

| Parameter | Phenolization | Matrix excision | p-value |
|---|---|---|---|
| Recurrence | | | |
| At 1 month | Nil | Nil | |
| At 6 month | | | |
| Yes | 6 (3.3%) | 15 (8.2%) | 0.037 |
| No | 85 (46.7%) | 76 (41.8) | |
| Spike formation | | | |
| At 1 month | Nil | Nil | |
| At 6 month | | | |
| Yes | 0 (0%) | 6 (3.3%) | 0.013 |
| No | 91 (50%) | 85 (46.7%) | |

(partial nail avulsion with phenolization) experienced less post-operative pain compared to group-A (partial nail avulsion with matrix excision) at 2nd and 7th day of evaluation using VAS (Table I). The p-value at 2nd and 7th day of evaluation was 0.000 and 0.031, respectively which was deemed significant.

On 7th day of evaluation for post-operative infection, a total of 6% (n=11) patients had signs of wound infection of which 2.2% (n=4) were from group-B (phenolization) and 3.8% (n=7) from group-A (matrix excision). There was no significant difference found in the effect of phenol and matrix excision in inducing signs of infection after 7 days (p=0.351). (Table-II)

The incidence of recurrence following partial nail avulsion with phenolization (group-B) as opposed to matrix excision (group-A) differed significantly (Table-III). Compared to 8.2% (n=15) patients who had matrix excision (group-A), only 3.3% (n=6) patients who had phenolization (group-B) experienced recurrence of the IGTN at 6-months. (p-value= 0.037)

Lastly, spike formation was evaluated at 1 and 6-months post-operatively revealing group-B (phenolization) had no spike formation versus group-A (matrix excision) with 3.3% (n=6). The p-value was 0.013 which is statistically significant and implies that partial nail avulsion with phenolization has lesser post-operative incidence of spike formation compared to matrix excision (Table-III).

**Discussion**:

Ingrown toenail (IGTN) is a common problem affecting individuals around the world. Various conservative and surgical managements have been described.[1,7,8] Theoretically, an ideal management option would be the one with least incidence of recurrence, post-op infection, early return to work, cost-effective, and easily do-able in the day-care setting.[10]

Historically, many surgical techniques are described but no single technique is ideal in terms of lowering the risk of recurrence. This study compares two commonly used surgical procedures i.e. partial nail avulsion with matrix excision versus phenolization.

Recently, Vinay K. et al. in the systematic review of phenol-based partial matricectomy clearly outweighed this technique in terms of lower recurrence rates and post-operative pain.[11] This review shows results in conjunction with our study. The application of phenol after partial nail avulsion chemically ablates the germinal epithelium leading to reduced recurrence after procedure. Mayeaux EJ Jr. and colleagues found that partial nail avulsion with chemical matricectomy (phenol) was far superior to other techniques in terms of reducing the recurrence and post-op

complications.[1] A randomized clinical trial conducted by Muriel-Sánchez JM et al, shows clear-cut beneficial results of chemical matricectomy with phenol in terms of reducing recurrence.[12] However, the use of phenol is a double-edged sword as it is not entirely risk-free to the patient and surgeon leading to burns and possible worse outcomes.[13]

The study shows that patients who underwent phenolization experienced significantly less pain post-operatively compared to the other group. Several studies confirm these results.[12,14] However, a blinded randomized study conducted recently revealed that patients receiving chemical-cautery after partial nail ablation experience more pain compared to others at 7th post-op day.[15]

Post-operative infection is a main concern in surgery and IGTN surgery is no exception as well. Terrill A.J et al, recently described the risk factors for infection following IGTN surgery. They concluded that radical excision of the toenail bed were associated with highest incidence of post-op infection.[16] Noula A.G.M and his colleagues reported a case of big toe amputation due to post-operative infective gangrene following IGTN partial nail avulsion with matricectomy.[17] Several studies shows partial nail avulsion with phenolization is superior to avulsion alone or matricectomy in terms of reduced incidence of post-operative infection.[18,19] Our study compares the two groups and shows that no significant difference lie in either technique in terms of post-operative infection (p-value=0.351).

Another cumbersome complication of ingrown toenail surgery is spike formation. This study shows no-spike formation in phenolization group in the follow-up period; with matrix excision group spike formation incidence being 3.3% (n=6). Vaccari S. et al, reported similar results i.e. 0% spike formation in patients who underwent phenolization after partial nail avulsion.[20] Bos AM. et al, in a randomized clinical trial reported partial nail avulsion with phenolization far better in terms of post-op spike formation compared to partial nail avulsion with matrix excision.[21]

**Conclusion**:
The partial nail avulsion with localized phenol use is a significantly better management option compared to partial nail avulsion with matrix excision in terms of reducing recurrence, spike formation, and post-operative pain.

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**Role and contribution of authors**:
Syed Shams ud Din, collected the data, references and did the initial writeup

Inayat ullah Baig, collected the data and helped in introduction writing.

Mirza Tassawar Hussain, collected the data, references and helped in discussion writing.

Erum Khan, collected the data, references and helped in compiling the results.

Talha Humayun, collected the data, and helped in introduction writing.

Aqsa Syed, collected the data, references and helped in abstract writing.

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